

JC06 Rec'd PCT/PTO 14 OCT 2005

Patent claims

1. Article whose surface exhibits a composite material, in full or in parts, the composite material consisting of a non-metallic substrate containing at least one polymer, and a metallic layer present thereon and deposited without external current, having an adhesive strength of at least 4 N/mm² characterised in that the boundary layer present between the non-metallic substrate and the metallic layer exhibits a calcium content, determined by EDX analysis of a microtome section, of maximum 0.5 % by wt., based on an analysis area of 1 x 1 μm whose centre runs through the boundary layer.
2. Article according to claim 1 whose surface exhibits a composite material in full or in parts, this composite material exhibiting a first non-metallic layer and a second metallic layer applied thereon characterised in that
 - a) the surface of the article is not chemically pretreated before the application of the metallic layer; and
 - b) the metallic layer is not applied by thermal spraying, CVD, PVD or laser treatment.
3. Article according to claim 1 characterised in that the boundary present between the non-metallic substrate and the metallic layer exhibits a roughness with an R_z value of maximum 35 μm .
4. Article according to claim 1, 2 or 3 characterised in that the non-metallic layer contains at least one fibre-reinforced polymer, in particular a polymer reinforced with carbon fibre and the diameter of the fibre is less than 10 μm .
5. Article according to claim 1 characterised in that the boundary present between the non-metallic substrate and the metallic layer exhibits a roughness with an R_z value of maximum 100 μm and that the non-metallic substrate contains at least one fibre-reinforced polymer, in particular a polymer reinforced with glass fibre, and the diameter of the fibre is more than 10 μm .
6. Article according to one of the preceding claims characterised in that the non-metallic substrate is the surface of the article.

7. Article according to one of claims 1 to 5 characterised in that the non-metallic substrate is not the surface of the article.
8. Article according to one of the preceding claims characterised in that the standard deviation of the adhesive strength of the metallic layer at six different measured value points distributed over the surface of the composite material is maximum 25 %, in particular maximum 15 %, of the arithmetic mean.
9. Article according to one of the preceding claims characterised in that the polymer is selected from the group of polypropylene, polytetrafluoroethylene, polyamide, polyethylene, polyvinyl chloride, polystyrene, epoxy resin, polyether ether ketone, polyoxymethylene, polyformaldehyde, polyacetal, polyurethane, polyether imide, polyphenyl sulphone, polyphenylene sulphide, polyarylamide, polycarbonate and polyimide.
10. Article according to one of the preceding claims characterised in that the metal layer deposited without external current is a metal alloy or a metal dispersion layer.
11. Article according to one of the preceding claims characterised in that the metal layer deposited without external current is a copper, nickel or gold layer.
12. Article according claim 10 characterised in that the metal dispersion layer deposited without external current is a copper, nickel or gold layer with embedded non-metallic particles.
13. Article according to claim 12 characterised in that the non-metallic particles exhibit a hardness of more than 1,500 HV and are selected from the group of silicon carbide, corundum, diamond and tetraboron carbide.
14. Article according to claim 12 or 13 characterised in that the non-metallic particles exhibit friction-reducing properties and are selected from the group of polytetrafluoroethylene, molybdenum sulphide, cubic boron nitride and tin sulphide.
15. Article according to one of the preceding claims characterised in that, onto the metallic layer deposited without external current, a layer of aluminium, titanium or their alloys is applied whose surface is anodically oxidised or ceramics-treated.

16. Article according to claim 15 characterised in that one or several metallic layers are also arranged between the metallic layer deposited without external current and the layer of aluminium, titanium or its alloys.
17. Article according to claim 15 or 16 characterised in that the surface of the article is a ceramic oxide layer of aluminium, titanium or their alloys, which layer is coloured black by foreign ion embedments.
18. Process for the production of an article according to one of the preceding claims comprising the following steps:
 - i. the surface of the non-metallic layer is not chemically pretreated before applying the metallic layer deposited without electric current;
 - ii. the surface of the non-metallic layer is microstructured in a first step by a blasting agent;
 - iii. the metallic layer is subsequently applied by metal deposition without external current.
19. Use of an article according to one of claims 1 to 18 as roller for the sheet product processing industry (films, paper, textiles, printing), a structural part of turbomolecular pumps (ring for the compressor stage), handle for household equipment (saucepans, lids), components for the aeroplane industry (handle, handrail) and the space industry (sun sails), structural part for the electronics industry (condenser, sonic field condenser, sonic rider, microwave hollow-cored conductor, circuit breaker surface, antenna, antenna housing), structural part for the moveable structural parts of cyclones, wind sifters, structural parts subject to mechanical, thermal and/or chemical stresses for the motor vehicle industry (brake pistons for motor vehicles) or as a mould or component for the injection moulding industry.